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CHAPTER TWENTY-FOUR

AERIAL PHOTO CONTROL SURVEY

An aerial survey of a highway project produces a long, thin photographic mosaic that encompasses the survey limits of the project. Ground control points (i.e., panel points) and GPS technology are used to establish and maintain survey control during the project. A GPS survey is ideal as the traverse angles of a conventional survey generally do not close well on long highway projects. This chapter provides guidelines and procedures for implementing an aerial photo control survey on INDOT survey projects.

24-1.0 GUIDELINES AND PROCEDURES

24-1.01 Research

The Engineer's Report contains important information pertaining to the aerial photo control survey (i.e., project location and flight information). The report specifies the size of the panel points that are necessary for ground control during the aerial survey. It also specifies control location and the distance between successive controls. Upon receipt and review of the Engineer's Report, research should be performed to establish project control monumentation.

Traditional research entails a review of the USGS quadrangle maps that encompass the project. A good supplement to this base is the use of geodetic control diagrams. Unfortunately, the availability of these diagrams is limited as they are no longer published by NGS. There are a few, however, that are still maintained by NGS.

It is desirable to tie the aerial photo control into the USC&GS triangulation network, especially if GPS is utilized. For example, if GPS is used, then only one horizontal monument would need to be tied into the network. As practical, the vertical control should be based on NGS or USC&GS NAVD '88 datum. The accuracy of other agencies' datum (e.g., USGS, INDOT) is not as reliable because some of their recorded bench marks were based upon an estimated project elevation or were established by trigonometric observations. At least two vertical bench marks should be used. A third is desired in order to resolve any conflicts in elevation and to verify elevation transfers. If additional right-of-way is required for the project, then section corners should be tied into the survey as well. Chapter Twenty-two provides additional information pertaining to section corners, subdivision corners, and property corners.

24-1.02 Field Work

It is desirable that the located centerline control points, section corners and property corners be used as ground control points. Do not set road nails randomly, near the centerline or near property lines, as they may be confused with centerline and property corner monumentation. If a panel point location is desired near the centerline, then position it on or beyond the pavement edge. If however, the panel point must be located near the centerline, then set the panel point without a road nail. Instead, use a non-standard marker such as a roofing nail.

Traditionally, a cross shape has been used as the configuration of the panel point; however, a chevron shape is preferred by the Department. A non-standard marker should be driven either at the center of the cross or at the tip of the chevron panel point. This point should be referenced in the event the road is chipped and sealed before control can be run.

If a conventional survey is being conducted, then panel points may be established by a side shot. However, ensure that two sets of angles are taken as a verification check. Elevations may be carried with the traverse as long as the elevations close to third-order accuracy. The necessary measurements and computations should be made to substantiate the validity of results.

24-1.03 Accuracy and Precision

Unless GPS technology is used during the survey, a horizontal circuit should be run and closed with an unadjusted precision that is better than 1:20 000.

Elevations should be run to third-order accuracy as discussed in Chapter Twenty-two. As practical, the elevations should be tied to an NGS or USC&GS NAVD ‘88 datum bench mark to achieve a more reliable source of elevations.

24-1.04 Supplemental Survey Data

An aerial photo control survey is normally conducted in conjunction with, not in place of, a project’s ground survey (i.e., electronic or conventional) as INDOT projects typically require survey control and information beyond that which can be provided by aerial photographs alone. For example, a project may depend on information that is either relative to topographic features that are not distinguishable from the air or not directly related to ground topography (e.g., owner names, company names, addresses). The following presents a list of items that should be considered where an aerial photo control survey is necessary.

1. Survey Equations. Where equations to other surveys are necessary, it is impractical to expect that the required degree-of-accuracy will be obtained from aerial photography. Ground survey operations should be conducted to meet this objective.

2. Feature Proximity. It may be beneficial to detail the topography of features that are in close proximity to the proposed right-of-way. For example, ground survey details may reveal that a building could be saved by steepening the backslope or by constructing a retaining wall.

3. Utility Poles. As aerial photographs are typically shot normal to the prevailing terrain surface, utility poles rarely appear in the photograph. Where they do appear, however, it is extremely difficult to identify the type of pole. This information must be obtained in the field.

4. Underground Utilities. The location of subsurface features such as underground utilities, typically cannot be determined aerially using conventional photographic film media. A ground survey must be employed to verify the location of such items. Section 22-2.0 discusses the appropriate procedures for coordinating with utility companies during the survey.

5. Bodies of Water. It is extremely difficult to determine the elevations of features under water (e.g., stream bed, lake bottom) by employing the methods of conventional aerial photography. In cases where water is involved, determine underwater elevations during the ground survey.

6. Substantially Valued Trees. Trees of substantial value (e.g., fruit trees, hardwood trees, shade trees) that are close to the project right-of-way may become the subject of negotiation between the owner and the Department. The location of such items is critical and should be determined by the ground survey party.

7. Obscured Visibility. There may be a need to determine the topography of areas that are obscured from an aerial view (i.e., under tree canopies, building overhangs). Such topography should be collected using ground survey techniques.

Other information that is typically required during the project survey but cannot be adequately obtained from an aerial observation includes the following:

1. physical evidence of researched section, property lines, and corners;

2. drawings of section plats and key maps;

3. descriptions of bearing sources;

4. city or corporation limits;

5. field tile locations;

6. storm and sanitary drainage structure locations;

7. locations of utility lines;

8. utility company names and addresses;

9. present structure profile drawings;

10. profile of project baseline;

11. edges of pavement;

12. temporary bench marks that are set and described;

13. completed level circuit;

14. elevations of all drainage structures including headwalls, tops of openings, flowlines, tops of manhole rims, etc.;

15. elevations of overhead lines that are in close proximity to the project;

16. profile of railroad tracks;

17. high water elevations; and

18. any other feature that does not appear in an aerial observation and is critically located to the project.